Oceanographic Products and Services Division / Information Systems Branch

Information Systems Branch
PORTS Uniform Flat File Format
(PUFFF)

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PORTS UNIFORM FLAT FILE FORMAT

(PUFFF)

1. Introduction

Users of the Physical Oceanographic Real-Time System (PORTS) have requested access to PORTS information in a form that can be used as input to their own real-time applications. Until now, only a subset of data was displayed and available to the user. For example, only a single selected bin of ADCP data is reported/displayed via the PORTS screen, although many other bins are in fact collected, processed and available. The following is a suite of files and their descriptions that can be accessed to retrieve all of the PORTS observations as site-independent, flat, ASCII files in real time.

2. File and Table Descriptions

There are four file/table types that constitute an implementation of PORTS Uniform Flat File Format (PUFFF).

2.1 Measurement Files

There are currently four data types represented as measurement files. Each data type collected is recorded in a separate file, containing the most recent real-time observations. The names of the files follow the same convention as those found resident on the PORTS Data Acquisition System (DAS) platform, but with different extensions. These files are overwritten each sample (normally six minutes).

For example:

Water Level	Example File Name: 9414290.wl
Current	Example File Name: s01010.cu
Meteorological	Example File Name: 9414290.mt
Conductivity/Temperature	Example File Name: honker1.ct

Water Level stations use the seven digit National Water Level Measurement System standard identification. The current meter stations use the standard PORTS 6 character identifications, and Conductivity/Temperature stations are represented using plain text descriptive names. Instruments with multiple sensor or data types (i.e., water level gages) share the same identification prefix but are represented by different file extensions. The format of the data varies depending on sensor type.

Each file, besides the basic observed data, has several fields containing information regarding the quality of the data as determined on a real-time, single sample basis. These fields are the Data Quality Assurance (DQA) bit mask, Data Quality Class Code (DQCC), and Data Quality Action Codes (DQAC).

The DQA bit mask immediately follows the data fields on line 7. It consists of 32 digits, each digit either a zero or a one (0 or 1). Bit 0 (zero) is the first character, bit 31 is the last character. If the character is ‘1', this means it either failed a particular test or there is a cautionary note. The meaning of the bits varies according to the data type.

The DQCC and the DQAC follow the DQA bit mask. The DQCC is a three digit code. The first digit is ‘3' or ‘4'. If it is ‘3', there are no failure codes relating to real-time use of the data. If it is ‘4', the data failed the DQA in some way for real-time use. The next two digits are the number of DQAC’s following the DQCC. The DQAC’s are defined in Appendix IV.

2.2 Station Location Table Files

The Station Location Table (SLT) files are copies of the station location tables used operationally by the software resident on the DAS. Because of this, several records found in an SLT are of no relevance to the general user. These files contain information about the location, depth, sampling interval, and other information. The SLT files are named the same way as above, but with a “.ctl” extension. There may be more data files than SLT files because some stations provide multiple sensor/data types. See Appendix I for an example of a San Francisco SLT file.

2.3 Ports File Directory Table File

The PORTS File Directory Table (PFDT) file contains a list of the names of all of the data files associated with a particular PORTS site. The PFDT file is named after the PORTS site with a “.fd” extension. An example file name would be “sfports.fd” for San Francisco Bay PORTS. The first record in this file is an integer value equal to the number of data files associated with this PORTS site. This provides for easy maintenance if additional files are added or deleted. A simple “mget” command via an anonymous FTP transfer would get all of these files at once. See Appendix II for an example of a PFDT file.

2.4 Description Files

There are two types of informative description files. See Appendix III for examples of the Descriptions files.

> A readme file contains a general description of the overall design, data file descriptions of PUFFS and a list of technical contacts at NOAA. (File name *readme*)
>
> A Units file contains a description all of the units associated with each data type. (File name *units*)

3. Measurement File Formats

To support National Ocean Service and other users of this data, additional data fields may be added to the end of any line of information or additional lines at the end of the file. These added fields will not conflict with any data fields previously defined within this document. If added fields are determined to be generally useful to the user community, they will be made permanent and be fully described in the next release of this document.

All missing sample data fields are filled with nines. If no data was received in the latest sampling interval, all data fields except the date are irrelevant.

3.1 Header Records

Each measurement file contains a six line header. The first line is the name of the PORTS site that the data came from. Line 2 is the station id and name. At this time, lines three and four are undefined. Line five may contain raw data from the station and will vary depending on the instrument type. Line 6 contains a time stamp and possibly additional information. For example, current meter data includes the number of bins after the time and DQA information. For tide data only, If no data was received in the latest sampling interval, the character string ' NO DATA' follows the time stamp.

Line 1	name of the PORTS this data comes from
Line 2	station id and the name of the station.
Lines 3-4	undefined.
Line 5	none, some, or all of the raw data from the station.
Line 6	time-stamp in GMT (year, month, day, hour, minute). Additional fields after the time are described under each instrument type.

The **time-stamp** is in GMT and has the following format. All data fields are zero filled. (i.e January = 01 not 1).

YYYY MM DD HH mm [additional information]
Fortran format (1x,i4,4(1x,i2.2))
where YYYY = 4 digit year
MM = 2 digit month
DD = 2 digit day
HH = 2 digit hour (1 pm = 13)
mm = 2 digit minute
nnn = number of current meter bins

For example: August 29, 1998 at 4:29 P.M. would be written as

```
1998 08 29 16 29
```

3.2 Water Level Data Format

Lines 1-4 header lines as previously described
Line 5 contains all of the raw data received from the water level gage.
Line 6 GMT time-stamp, no-data indicator, rise/fall indicator
Line 7 Water level, standard deviation, and number of outliers. CORMS DQA bit mask, DQCC and DQAC.
Line 8 CORMS control word

Example

Line 1:
```
San Francisco PORTS
```

Line 2:
```
9414290 Golden Gate
```

Lines 3-4:
(undefined)

Line 5 (This all on one line):
```
9999.99999.999   64 310  6848    4.908 0.012  0    0.0    0.0
0.4  20   2.1  1020.4    5.445 0.013  0   21.5   13.1   99.9999.900
 -0.7 0  0.000  0.000  3.868   6.808   0.012   0   5.140   0.012
0
```

These values represent the following variables:

Datum offset	meters (f8.3)
Sensor offset	meters (f6.3)
bit status	binary mask
number of resets	Incrementing count
ROM checksum	decimal number
Primary water level (on station datum)	meters
Primary standard deviation	meters
Primary number of outliers	count (0 to 99)
Primary upper calibration temperature	degrees C
Primary lower calibration temperature	degrees C
Wind speed	meters/second
Wind direction	degrees True
Wind gust	meters/second
Air pressure	millibars
Secondary water level	meters
Secondary standard deviation	meters
Secondary number of outliers	count (0 to 181)

Secondary upper calibration temperature	degrees C
Secondary lower calibration temperature	degrees C
salinity	psu
humidity	% (actually conductivity)
water temperature	degrees C
use backup flag	0=use primary, 1=use secondary
backup gain	~ 1.0
backup offset	meters
staff MLLW	meters
N1 pressure sensor	dBars
N1 pressure sensor std. Deviation	dBars
N1 pressure sensor outliers	count
T1 pressure sensor	dBars
T1 pressure sensor std. Deviation	dBars
T1 pressure sensor outliers	count

Line 6: Time, with the no data flag, and the tide is rising

```
 1997 11 06 16 00 NO DATA +
```

Cols.	1-17	year, month, day, hour, minute (GMT)
Cols.	19-25	the phrase 'NO DATA' if no data was collected
Col.	27	If the tide is rising, a '+'. If the tide is falling, a '–'. If unable to determine rising or falling, it is blank.

Line 7:

```
  1275     64      2 00000010000000000000000000000000 300
```

Water elevation (relative to mean lower low water (MLLW)), standard deviation and outlier count [1], DQA bit mask, DQCC, and DQAC. Note, that because the DQCC was 300, there were no DQAC's following (3=no errors, 00=number of DQAC's).

Water elevation, standard deviation and outlier counts are integer values. The units for water elevation and standard deviation are millimeters and outliers is a count. Water elevation data is relative to MLLW. The format follows:

LLLLL MMMMM NNNNN ; Fortran format (3(1x,i5))

LLLLL = Water Elevation in millimeters

[1] **The tide gage processes 181 water level samples, 1 second apart, centered on the 6 minute mark. It then computes the standard deviation of the samples. Samples more than 3 sigmas away from the average are called "outliers". The "outliers" are removed from the samples and the standard deviation is recomputed. The number of outliers indicates how many samples were discarded. The standard deviation is a measure of noise in the water level environment. In a sheltered location, the typical standard deviation can be as low as 0.001 to 0.010 meters. More open locations could be higher, such as 0.150 meters. Every location is different.**

MMMMM = Standard Deviation in millimeters
NNNNN = Outlier Count

For example, a water elevation of 1.235 meters above MLLW, standard deviation of the water level sample 0.134 meters and 3 outliers would be written as

```
  1235   134    3
```

Line 8:

```
CORMS 00000000000000000000000000000000 00000000000000000000000000000000
```

This is the CORMS and Sensors control word. See Appendix V for a full description.

3.3 Water Level DQA Bit Mask Definitions

Each bit is labeled as to its importance.

Info	This is merely information; It does not reflect directly on the quality of the data.
Warning	This is a warning; the data quality may be affected
Failure	The data has failed a real-time QA check. Use at your own risk.

The first 10 bits (0-9) are for NOS internal analysis of gage operations only, and will not be explained further. Bits 10 and 11 are directly from the water level gage and are used for hardware evaluation and configuration. Bits 12-31 are based on DAS internal data quality assurance checks.

Bit 0	Info	ROM checksum error
Bit 1	Info	RAM error
Bit 2	Info	Systat bit 10 SDL, Systat 11 Tag missing
Bit 3	Info	Systat Bit 8 Term UART, Bit 9 Radio UART, Bit 12 Missing board, Bit 13 Met, Bit 14 GOES
Bit 4	Info	Battery < 12.5 volts
Bit 5	Info	8200 error
Bit 6	Info	Charger voltage < 15.0 volts
Bit 7	Info	> 5 sec off at sample end
Bit 8	Info	> 15 sec off at sample end
Bit 9	Info	8200 time update not enabled
Bit 10	Warning	Aquatrack error, zero returned for height recently
Bit 11	Warning	Primary frozen or not working, use secondary water level sensor. Set only by NOS personnel. If this bit is set, the water level data on line 7 is from the backup water level sensor.
Bit 12	Failure	Primary water level out of range
Bit 13	Failure	Primary water level standard deviation excessive
Bit 14	Failure	Primary water level number of outliers excessive

Bit 15	Failure	Secondary water level out of range
Bit 16	Failure	Secondary water level standard deviation excessive
Bit 17	Failure	Secondary water level number of outliers excessive
Bit 18	Info	primary Calibration temp. sensors out of range
Bit 19	Info	primary Calibration temp. sensors do not agree with each other
Bit 20	Info	secondary Calibration temp. sensors out of range
Bit 21	Info	secondary Calibration temp. sensors do not agree with each other
Bit 22	Failure	Gage time is incorrect by > 6 minutes
Bit 23	Info	Gage has been reset
Bit 24	Failure	Neither primary nor secondary gage is good
Bit 25	Failure	Primary water level sensor appears frozen (flat)
Bit 26	Failure	Secondary water level sensor appears frozen (flat)
Bit 27	Failure	Primary water level changed too fast
Bit 28	Failure	Secondary water level changed too fast
Bit 29	Failure	No data
Bit 30	Failure	Water level sensor disabled by CORMS
Bit 31		Undefined

3.4 CTD Data Format (Conductivity/Temperature/Depth(Pressure) Sensor)

The first six lines contain the previously defined header information. Line 7 contains salinity, water temperature and pressure. If the sensor is a Sea-bird, the three raw, unconverted data values for the conductivity, temperature and pressure are on line five in their original hex format (Fortran format '(3(1x,z4.4))'). If the ct data is from an Falmouth CT (standalone or installed with a tide gage), the original, full resolution conductivity and temperature follows the fields allocated for Seabird hex data on line five, (Fortran format '(15x,2i5)', with the conductivity in milli-Siemens/centimeter*1000) and the temperature in °C*1000. Line 8 contains the CORMS control word as described in Appendix V.

Salinity, temperature data and pressure are integer values. The units for salinity are PSU*1000, temperature is °C*100, and pressure is decibars*100. The data has the following format:

```
sssss ttttt ppppp     ;       Fortran format (3(1x,i5))
where sssss           = salinity as a integer (PSU*1000)
      ttttt           = temperature as a integer (°C*100)
      ppppp           = pressure as an integer (decibars*100)
```

For example: 3.55 PSU, 15.3°C and pressure of 15.12 dBars with the DQA and DQAC would be read

```
 3550  1530  1512 00000000000000000000000000000000 300
```

Conductivity/Temperature/Pressure DQA Bit Mask definitions

Each bit is labeled as to its importance.

Info	This is merely information; it does not reflect directly on the quality of the data.
Warning	This is a warning; the data quality may be affected.
Failure	The data has failed a real-time QA check; use at your own risk.

Bit 0	Failure	salinity out of range
Bit 1	Failure	salinity zero
Bit 2	Failure	water temperature out of range
Bit 3	Failure	Time is > 6 minutes off
Bit 4	Warning	Salinity is flat
Bit 5	Warning	Water temperature is flat
Bit 6	Failure	No data
Bit 7	Failure	barometric pressure is out of range
Bit 8	Warning	barometric pressure is flat
Bit 9	Failure	water temperature sensor disabled by CORMS
Bit 10	Failure	conductivity (salinity) sensor disabled by CORMS

3.5 Current Data Format

The format of the current meter data is a function of the instrument type. RD Instruments (NarrowBand and BroadBand) are four beam instruments while SonTek's are three beams. Each instrument also measures different parameters for quality assurance. All instruments have the time line (line 6), modified by adding DQA information after the time.

Line 6: The **time-stamp** is in GMT and has the following format. All data fields are zero filled. (i.e January = 01 not 1). The time is followed by the number of bins, DQA bits and DQCC codes.

YYYY MM DD HH mm nnn DQA DQCC (DQAC)
Fortran format (1x,i4,4(1x,i2.2),1x,i3,1x,32i1,1x,i3,20(1x,a4))

where YYYY = 4 digit year
MM = 2 digit month
DD = 2 digit day
HH = 2 digit hour (1 pm = 13)
mm = 2 digit minute
nnn = number of current meter bins
DQA = 32 one digit fields, each digit is 0 or 1
DQCC= data quality class code * 100 plus the number of DQAC fields following on the same line

For example: August 29, 1998 at 4:29 P.M. would be written as

```
1998 08 29 16 29 016 00000000000000000000000000000000 300
```

RDI Current Profilers (NarrowBand and Broadband)

3.6 RDI NarrowBand ADCP Data Format

Lines 1-6 contain header information as previously described. Line 5 contains instrument-specific information. The data is heading, tilts, water temperature, and serial number, using Fortran format (4i6,a8). An example follows, with a heading of 278.15 degrees (magnetic), x tilt of 10.4 degrees, y tilt of 2.05 degrees, temperature of 30.15 degrees C, and a serial number of 'RDI006':

```
 27815   104   205  3015  RDI006
```

The current data starts on line 7, and has the following format:

B1 uuuuuu vvvvvv wwwwww eeeeee dddddd ssssss bback1 bback2 bback3 bback4 %beam1%beam2 %beam3 %beam4 watemp bindqa spectral bstat

using Fortran format (1X,I3,15(1X,I6),1X,32I1,12(1X,I5))

where all of the variables are integers, one line per bin, and in the following order:

B1 to Bn	= bin number (1 to a maximum of 128)
uuuuuu	= u velocity in mm/s (+ = east, – = west, magnetic)
vvvvvv	= v velocity in mm/s (+ = north, – = south, magnetic)
wwwwww	= w velocity in mm/s (vertical)
eeeeee	= error velocity in mm/s
dddddd	= direction (degrees True)
ssssss	= velocity in mm/s
bback1	= echo amplitude (relative dB)
bback2	= echo amplitude (relative dB)
bback3	= echo amplitude (relative dB)
bback4	= echo amplitude (relative dB)
%beam1	= % good pings beam 1 (0 to 100)
%beam2	= % good pings beam 2 (0 to 100)
%beam3	= % good pings beam 3 (0 to 100)
%beam4	= % good pings beam 4 (0 to 100)
watemp	= water temperature (c*100)
bindqa	= DQA bin specific bit mask (each digit 0 or 1)
spectral	= spectral width (0 to 255)
bstat	= bin status (0 to 255)
rveloc	= raw beam counts used for current speed (0 to 4095)

RDI NarrowBand ADCP's have information in the raw data header that is not directly needed to use the currents information. However, we have added all of the header data beginning on a new line directly after the last bin of current data. The

format is a string of 8 digit integer fields, with 10 fields per line, with as many lines as necessary for all of the data. The following are the definitions for all of the header information variables in the same order as in the files:

Variable	Units
Time between pings	seconds*100
Pings per ensemble	count
bin length	meters
transmit pulse length	meters
blanking distance	whole meters (any fraction is truncated)
delay after blank	meters
ensemble number	sequential count, max of 65535, then rolls over to 0
BIT status	result of built-in-tests
velocity range switch setting	0=low range, 1=high range
velocity reference	0=beam coordinates, 1=earth coordinates
transducer orientation	0=upward looking, 1=downward looking
transducer pattern	0=convex, 1=concave
transducer frequency	Hertz
valid	are the previous 5 fields valid, 0=no, 1=yes
signal to noise threshold	dB
percent good pings limit	percent
high voltage input	volts * 100
transmit current	amps * 100
low voltage input	volts * 100
CTD conductivity count	
CTD temperature count	
CTD depth count	
btv1	Bottom tracking velocity count, beam 1
btv2	Bottom tracking velocity count, beam 2
btv3	Bottom tracking velocity count, beam 3
btv4	Bottom tracking velocity count, beam 4
btr1	Bottom tracking range, beam 1
btr2	Bottom tracking range, beam 2
btr3	Bottom tracking range, beam 3
btr4	Bottom tracking range, beam 4
stdpitch	standard deviation of pitch, degrees * 10
stdroll	standard deviation of roll, degrees * 10
stdheading	standard deviation of heading, whole degrees
ctdmeasure	CTD measurement interval, seconds * 1000

The last line in the file is the CORMS control word as described in Appendix V.

3.7 RDI BroadBand ADCP Data Format

Lines 1-6 contain header information as previously described. Line 5 contains instrument specific information. The data is heading, tilts, water temperature, built-in-test status, speed-of-sound and serial number, using Fortran format (6i6,a8). An example follows, with a heading of 278.15 degrees (magnetic), x tilt of 1.04 degrees, y tilt of 2.05 degrees, water temperature of 30.15 degrees C, built-in-test value of 0, speed-of-sound of 1500 meters/second and serial number of 'RDI026':

```
 27815   104   205  3015     0  1500  RDI026
```

The current data starts on line 7, and has the following format:

B1 uuuuuu vvvvvv wwwwww eeeeee dddddd ssssss bback1 bback2 bback3 bback4 %beam1%beam2 %beam3 %beam4 watemp bindqa corr% bstat

Fortran format (1X,I3,15(1X,I6),1X,32I1,8I4)

where all of the variables are integers, one line per bin, and in the following order:

B1 to Bn	= bin number (1 to 128)
uuuuuu	= u velocity in mm/s (+ = east, – = west, magnetic)
vvvvvv	= v velocity in mm/s (+ = north, – = south, magnetic)
wwwwww	= w velocity in mm/s (vertical)
eeeeee	= error velocity in mm/s
dddddd	= direction (degrees True)
ssssss	= velocity in mm/s
bback1	= echo amplitude (relative dB)
bback2	= echo amplitude (relative dB)
bback3	= echo amplitude (relative dB)
bback4	= echo amplitude (relative dB)
3beam	= % of good three beam solutions
transrej	= % of transformations rejected
morebad	= % with more than one beam bad in bin
4beam	= % of good 4 beam solutions
watemp	= water temperature (c*100)
bindqa	= DQA bin specific bit mask (each digit 0 or 1)
corr%	= correlation coefficient for each of the four beams (percent, 0 to 100)
bstat	= beam status for each of the four beams (0 or 1)

RDI BroadBand ADCP's have information in the raw data header that is not directly needed to use the currents information. However, we have added all the header data beginning on a new line directly after the last bin of current data. The format is a string of 8 digit integer fields, with 10 fields per line, with as many lines as necessary for all of the data. The following are the definitions of all of the header information variables in the same order as in the file:

Variable	Units
CPU firmware version	number (0 to 255)
CPU firmware revision	number (0 to 255)
transducer frequency	Hertz (0 to 2400kHz)
transducer configuration	0=concave, 1=convex
transducer beam angle	degrees (15,20,30,0=other)
transducer orientation	1=upward looking, 0=downward looking
Janus configuration	4=4 beam, 5=5 beam (3 demod.), 15=5 beam (4 demod.)
Sensor configuration	0 to 3
coordinate transform	0=none (beam), 1=instrument, 2=ship, 4=earth
number of beams used in calculations	not number of physical beams
pings per ensemble	count (0 to 16384)
bin length	meters * 100
blanking distance	meters * 100
profiling mode	0 to 255
correlation threshold	counts (0 to 255)
code repetitions in transmit pulse	counts (0 to 255)
minimum percent good pings	percent (0 to 100)
error velocity threshold	meters/second * 1000 (0 to 5000)
tilts used	0=no, 1=yes
3 beam solutions used	0=no, 1=yes
bin mapping used	0=no, 1=yes
heading alignment correction	degrees * 100
heading bias correction	degrees * 100
sensor source	source of env. Sensor data (see RDI manual) (0 to 255)
bin 1 distance (to center of bin)	meters * 100 (0 to 65535)
transmit pulse length	meters * 100 (0 to 65535)
reference layer start bin	0 to 128 (0=reference layer not used)
reference layer end bin	1 to 128
false target threshold	counts (0 to 255), 255=disabled
transmit lag distance	meters * 100 (0 to 65535)
ensemble number	sequential count (0 to 2**24-1)
water pressure	meters * 10 (manual or sensor value)
salinity	parts/thousand (manual or sensor value)
maximum time between ping groups	seconds * 100
standard deviation of heading	degrees
standard deviation of roll	degrees * 10
standard deviation of pitch	degrees * 10
ADC channel 0 - transmit current	(0 to 255)
ADC channel 1 - transmit voltage	(0 to 255)
ADC channel 2 - DAC output	(0 to 255)
ADC channel 3 - temperature	(0 to 255)

ADC channel 4 - VDD3	(0 to 255)
ADC channel 5 - VDD1	(0 to 255)
ADC channel 6 - VDC	(0 to 255)
ADC channel 7 - reserved	

The last line in the file is the CORMS control word as described in Appendix V.

3.8 SonTek ADP Data Format

SonTek Current Profiler

Lines 1-6 contain header information as previously described. Line 5 contains instrument specific information. The data is written using Fortran format (11i6,2i10) in the following order:

Variable	Units
heading	degrees * 10
pitch	degrees * 10
roll	degrees * 10
temperature	degrees C * 100
water pressure	decibars * 100
standard deviation of heading	degrees * 10
standard deviation of pitch	degrees * 10
standard deviation of roll	degrees * 10
standard deviation of temperature	degrees C * 100
standard deviation of water pressure	decibars * 100
speed of sound	meters/second * 10
pressure sensor offset	decibars * 1000000
pressure sensor scale	*1000000000

The current data starts on line 7, and has the following format:

B1 uuuuuu vvvvvv wwwwww dddddd ssssss bback1 bback2 bback3 stddev1 stddev2 stddev3 watemp bindqa

Fortran format (1X,I3,12(1X,I6),1X,32I1)

where all the variables are integers, each bin on a single line and in the following order:

B1 to Bn	= bin number (1 to 128)
uuuuuu	= u velocity in mm/s (+ = east, – = west, magnetic)
vvvvvv	= v velocity in mm/s (+ = north, – = south, magnetic)
wwwwww	= w velocity in mm/s (+ = up, – = down)

dddddd	= direction (degrees True)
ssssss	= velocity in mm/s
bback1	= echo amplitude (relative dB)
bback2	= echo amplitude (relative dB)
bback3	= echo amplitude (relative dB)
stddev1	= standard deviation for beam1 (millimeters/sec)
stddev2	= standard deviation for beam2 (millimeters/sec)
stddev3	= standard deviation for beam3 (millimeters/sec)
watemp	= water temperature (°C * 100)
bindqa	= bin related DQA bit mask

SonTek ADP's have information in the raw data header that is not directly needed to use the currents information. However, we have added all of the header data beginning on a new line directly after the last bin of current data. The format is a string of 8 digit integer fields, with 10 fields per line, with as many lines as necessary for all of the data. The following are the definitions for all of the header information variables in the same order as in the file:

Variable	Units
serial number	8 characters
data type	SonTek internal use
profile (ensemble) number	sequential
number of beams	3 or 4
vertical beam	0=no, 1=yes
sensor orientation	0=downward, 1=upward 2=sideways
temperature mode	0=user, 1=measured
coordinate transform mode	0=beam, 1=XYZ, 2=ENU (magnetic, earth)
bin length	centimeters
blanking distance	centimeters
sampling interval	seconds
number of pings	count
16 internal values	SonTek internal use
pressure sensor	counts, requires sensor offset and scale to use. Multilply by pressure sensor scale and add the pressure sensor offset to get the pressure in decibars as on line 6.

3.9 DQA bit mask – SonTek ADP and RDI ADCP

Each bit is labeled as to it's importance.

Info	The is merely information; it does not reflect directly on the quality of the data.
Warning	This is a warning; the data quality may be affected.
Failure	The data has failed a real-time QA check; use at your own risk.

DQA Header bit map

Bit 0	Warning	time is incorrect
Bit 1	Warning	pitch changed
Bit 2	Failure	pitch illegal value
Bit 3	Warning	roll changed
Bit 4	Failure	roll illegal value
Bit 5	Warning	heading changed
Bit 6	Failure	heading illegal value
Bit 7	Warning	real-time bin lowered
Bit 8	Failure	no real-time bin found to be good
Bit 9	Warning	current meters has been re-started
Bit 10	Warning	pressure sensor out of range
Bit 11	Warning	water temperature sensor out of range
Bit 12	Warning	wrong serial number
Bit 13	Warning	wrong number of bins
Bit 14	Failure	wrong bin size
Bit 15	Failure	wrong sampling interval
Bit 16	Failure	wrong coordinate system
Bit 17	Warning	wrong blanking distance
Bit 18	Warning	RDI ADCP BIT error
Bit 19	Warning	Not enough 4 beam solutions
Bit 20	Failure	Not enough 3+4 beam solutions
Bit 21	Warning	Excessive vertical velocity
Bit 22	Warning	Excessive error velocity
Bit 23	Failure	Not enough good pings
Bit 24	Failure	No data
Bit 25	Failure	(not implemented yet) Data is no good, set if any header failure codes
Bit 26	Info	This is a prediction file. Only the bins indicated by bit 15 in the DQA bin related bit map are valid. Only speed, direction, north and east velocities are valid.
Bit 27	Warning	There are warnings for various types of bin related errors. Examine the DQA Bin related bit maps for the specific warnings.
Bit 28	Failure	All currents disabled by CORMS
Bit 29	Failure	water pressure sensor disabled by CORMS

Bit 30	Failure	water temperature sensor disabled by CORMS
Bit 31		undefined

DQA Bin related bit map

Bit 0	Failure	illegal speed
Bit 1	Failure	high standard deviation
Bit 2	Warning	low echo amplitude
Bit 3	Warning	low correlation magnitude
Bit 4	Warning	high vertical velocity
Bit 5	Warning	speed or direction is 0.000
Bit 6	Failure	illegal direction
Bit 7	Info	This bin was used for this real-time sample
Bit 8	Info	This is the default real-time bin
Bit 9	Failure	not enough 3 or 4 beam solutions
Bit 10	Warning	not enough 4 beam solutions
Bit 11		undefined
Bit 12	Warning	Excessive error velocity
Bit 13	Failure	Not enough good pings
Bit 14	Failure	(not implemented yet) Set if any bin related Failure codes
Bit 15	Info	This is predicted data. Only speed, direction, north and east velocities are valid.
Bits 16-31		undefined

3.10 Meteorological Data Format

Lines 1-6 contain header information as previously described. Line 7 contains wind speed, wind direction, wind gust, barometric pressure, and air temperature.

All of the **meteorological data** values are of type integer. Line 7 has the following format:

wwwww ddddd ggggg bbbbb ttttt DQA DQAC
where wwwww = Wind Speed (meters/second * 10)
ddddd = Wind Direction (degrees true)
ggggg = Maximum Wind Gust (meters/second *10)
bbbbb = Barometric Pressure (millibars*10)
ttttt = Air Temperature (°C*100)

3.11 Meteorological Sensor DQA status word

Each bit is labeled as to it's importance.

Info	This is merely information; it does not reflect directly on the quality of the data.
Warning	This is a warning; the data quality may be affected.
Failure	The data has failed a QA check; use at your own risk.

Bit 0	Failure	Wind speed out of range
Bit 1	Warning	wind speed is flat
Bit 2	Failure	Wind gust out of range
Bit 3	Failure	Air temperature out of range
Bit 4	Warning	Air temperature is flat
Bit 5	Failure	Barometric pressure out of range
Bit 6	Warning	Barometric pressure is flat
Bit 7	Failure	Time is > 6 minutes off
Bit 8	Failure	Illegal wind direction
Bit 9	Failure	No data
Bit 10	Failure	wind speed sensor disabled by CORMS
Bit 11	Failure	Barometric pressure sensor disabled by CORMS
Bit 12	Failure	Air Temperature sensor disabled by CORMS
Bits 13-31		undefined

4. PUFFF Access

The PUFFF files are produced on the PORTS Data Acquisition System (DAS) platform at each of the PORTS sites during the data collection process. After the files are created on the DAS, they are transferred to Silver Spring, Maryland via Internet. The files are then available to any user via anonymous FTP.

The anonymous FTP server in Silver Spring where these files can be retrieved is named "tidepool.nos.noaa.gov" (140.90.78.210). Users are allowed to FTP into the system via an anonymous login that requires an e-mail address as a password. Once connected, a user can move to the PUFFF directory and sub-directory of interest to retrieve the PUFFF files.

The FTP directory structure where the PUFFF files can be found:

/pub/PUFFF/akports	Port of Anchorage PORTS
/pub/PUFFF/cbports	Chesapeake Bay PORTS
/pub/PUFFF/dbports	Delaware Bay and River PORTS
/pub/PUFFF/hgports	Houston/Galveston Bay PORTS
/pub/PUFFF/llports	Los Angeles/Long Beach PORTS
/pub/PUFFF/nbports	Narragansett Bay PORTS
/pub/PUFFF/nyports	New York/New Jersey PORTS
/pub/PUFFF/sfports	San Francisco Bay PORTS

/pub/PUFFF/tbports Tampa Bay PORTS

5. Time-Stamp Explanation

The “time-stamp” is the time associated with the data sample collected from each instrument. The time stamp is centered on the midpoint of each instruments sample interval.

The time-stamp for the water level data will always be on the six minute mark. If there are any ancillary sensors connected to the water level site (such as conductivity/temperature or meteorological data), its time-stamp will also be on the six minute mark.

The time-stamp for other files is arbitrary and depends upon instrument configuration and available time window to collect a sample from an instrument. This will vary, depending on individual PORTS sites. Barring missing samples or reconfiguration of the instrument, the time stamps will be six minutes apart for successive files.

There is a three to twelve minute lag between wall clock time and the time-stamp. This is because of the time it takes to poll the instruments, process the data, and move it to our FTP site.

If the user wishes to automate the downloading of PUFFS data from our server, the optimal time to retrieve the data is approximately the six minute mark. .[2]

[2] **Data is sent over the Internet from each PORTS DAS to a server located in Silver Spring, Maryland. Because the Internet is used, the time it takes to complete the transmission of the data varies from PORTS site to PORTS site and would therefore affect the optimum time to retrieve PUFFF files.**

APPENDIX I — Station Location Table Examples

Water Level

```
9414290                          station id
Golden Gate                      station name
i050                             instrument id number
/ports                           absolute unix directory       path
/archive                         data path
/tables/locat                    station table path
/tables/instr                    instrument table path
/tables/critr
/tables/const                    path to harmonic constants
  37 48 24                       latitude north                 dd mm ss
 122 27 54                       longitude west                ddd mm ss
360                              transmit interval             seconds
MLLW                             tide datum
Feet                             output data units
0.3048                           divide input by this to get output units
Meters                           input data units
1.759                            staff correction              meters
0                                gage time                     hours
8                                local standard time zone      hours
```

Conductivity/Temperature/Depth

```
benicia1                         station id
Benicia Bridge                   station name
p406                             instrument id number
/ports                           absolute unix directory       path
/archive                         data path
/tables/locat                    station table path
/tables/instr                    instrument table path
/tables/critr                    data criteria path
/tables/calib                    calibration data path
/tables/const                    path to harmonic constants    path
  38 05 18                       latitude north
 122 09 42                       longitude west
360                              transmit interval             seconds
0                                depth  0=surface,9999=bottom  meters
0                                gage time zone                hours
8                                local standard time zone      hours
3                                ZENO id
```

Current Meter

```
s01010                          station id
Benicia Bridge                  station name
i060                            instrument id number
                                calib id number              adcp
                                calib id number              press
                                calib id number              temp
                                calib id bumber              cond
/tables/critr                   criteria file path
/ports                          absolute unix directory      path
/archive                        raw hex data path
/tables/calib                   calib table path
/tables/instr                   instrument table path
/tables/locat                   station table path
  38 02 29                      latitude north
 122 09 31                      longitude west
63.0                            charted depth                feet
63.0                            fathometer reading           feet
hard clay                       bottom type
24.50                           ht. trans. above bottom      inches
                                weather
                                divers observations
                                length of deployment         days
rt                              operational mode (rt or sc)
01 23 1995 00.00                start time first record      m d y hh.hh gmt
                                stop time last record        m d y hh.hh gmt
20                              number of bins sampled
2.0                             bin length                   meters
1                               pulse rep. rate              seconds
1                               transmit interval            seconds
2.0                             depth cell length            meters
0.0                             blanking time
0.5                             blanking distance            meters
256                             # pings per ensemble
25                              % good threshold
1.00                            time between pings           seconds
360                             ensemble period              seconds
15.65                           compass deviation            degrees
adcp/devel                      processed data file path
0                               speed range (0=low,1=high)
 5.0                            salinity                     ppt
50                              flood direction              degrees True
230                             ebb direction                degrees True
0                               adcp orientation, see devel.f (1-4)
6                               bin to use for real-time
8                               local standard time zone     hours
0                               adcp type(0=narrowband,1=broadband,3=SonTek)
502                             binary size of one record (bytes,not hex)
```

APPENDIX II — PORTS File Directory Table Example

San Francisco PORTS (sfports.fd)

```
15
9414290.wl
9414750.wl
9414863.wl
9415144.wl
s01010.cu
s02010.cu
s03010.cu
grizzly1.ct
honker1.ct
9414290.mt
9414750.mt
9414863.mt
9415144.mt
readme
units
```

Example Filename Explanations

9414290.wl	Golden Gate Water Levels
9414750.wl	Alameda Water Levels
9414863.wl	Richmond Water Levels
9415144.wl	Port Chicago Water Levels
s01010.cu	Benicia Bridge Currents
s02010.cu	Richmond Currents
s03010.cu	Oakland Currents
s04010.cu	Golden Gate Currents

APPENDIX III — Documentation and Contacts

For a copy of the PORTS Uniform Flat File Format (PUFFF) document, see our home page located on our Web site “co-ops.nos.noaa.gov”. Any future changes and/or corrections to this document will appear first on this home page. This document undergoes continuous changes as necessary. If you detect changes or additions to any of the PUFFF files, your first action should be to get the latest copy of this document available. Not all changes are significant enough to generate a full revision, but there can be continuous small additions to this document.

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APPENDIX IV — Data Quality Action Codes

Water Level Gage DQAC

The following codes are determined directly, they are not from the criteria table.

FNOD No data was received. The time stamp is correct, but no other data is usable.

WAQT Aquatrak failure flag set (from bit 10 of the gage status word)

FTIM Gage time is wrong. All data is considered to be invalid. The time stamp has been changed to a reasonably correct value only so the user knows what the time should have been.

FCSW Water level has been disabled by CORMS

These codes are taken from the criteria tables.

Warning	Failure	Change	Description
WOW1	FOW1	DOW1	observed water level (meters), primary
WOU1	FOU1	DOU1	outliers (count), primary
WSD1	FSD1	DSD1	std. deviation (meters), primary
WCT1	WCT1	DCT1	cal temp C, primary
WOW2	FOW2	DOW2	observed water level (meters), secondary
WOU2	FOU2	DOU2	outliers (count), secondary
WSD2	FSD2	DSD2	std. deviation (meters), secondary
WCT2	WCT2	DCT2	cal temp C, secondary
WWSP	FWSP	DWSP	wind speed m/s
WWSG	FWSG	DWSG	wind gust m/s
WWDI	FWDI	DWDI	wind direction degrees True
WSAL	FSAL	DSAL	salinity ppt
WWTM	FWTM	DWTM	water temperature degrees C
WATM	FATM	DATM	air temperature degrees C
WAPR	FAPR	DAPR	air pressure millibars

Currents DQAC

The following codes are determined directly, they are not from the criteria table.

FNOD No data was received. The time stamp is correct, but no other data is usable.

FTIM Instrument time is wrong. The time stamp has been corrected to a reasonable value only so the user can determine what the time should have been. All data is considered invalid.

WRTB Real-time bin has been lowered.

FRTB No data is good enough for real-time use.

FCSC Currents data has been disabled by CORMS.

FCST Water temperature has been disabled by CORMS.

FCSP Water pressure has been disabled by CORMS.

These codes are taken from the criteria tables.

Warning	Failure	Change	Description
WSPD	FSPD	DSPD	min/max speeds cm/s
WSTD	FSTD	XXXX	stdev. of speed cm/s
WXTL	FXTL	DXTL	pitch (x axis) degrees
WYTL	FYTL	DYTL	roll (y axis) degrees
WHDG	FHDG	DHDG	heading degrees
WXTM	WXTM		water temp deg C
WVT1	WVT1		V1 volts
WVT2	WVT2		V2 volts
WIC2	WIC2		Transmit current amps
WENS	WENS		ensemble number count
WBIT	WBIT		BIT (built in test)
WDPW	WXPR		pressure decibars
WVRV	FVRV		vert. vel cm/s
WERV	FERV		error vel cm/s
WGPW	FGPZ		%good pings count
WEAM	FEAM		echo amp. db
WCMG	FCMG		correlation coeff counts
WSOS	FSOS		speed of sound m/s
WTCV	XXXX		transmitter charge volts
WTIP	XXXX		transmitter power amps
WTPV	XXXX		transmitter power volts
WTTC	XXXX		transmitter temp deg C
W4BS	W4BS		% of 4 beam BBADCP solutions
W3BS	F3BS		% of at least 3 beam BBADCP solutions
WRT1	FRT1		limits for real-time bin to use

CT(D) DQAC

The following codes are determined directly, they are not from the criteria table.

FNOD No data was received. The time stamp is correct, but no other data is usable.

FTIM Instrument time is wrong. The time stamp has been corrected to a reasonable value only so the user can determine what the time should have been. All data is considered invalid.

FCSS Salinity (conductivity) sensor dissemination has been turned off by CORMS.

FCST Water temperature has been disabled by CORMS.

FCSP Water pressure has been disabled by CORMS.

These codes are taken from the criteria tables.

Warning	Failure	Change	Description
WSAL	FSAL	DSAL	salinity ppt
WWTM	FWTM	DWTM	water temperature degrees C
WWPR	FWPR	DWPR	water pressure pressure decibars

Meteorological DQAC

The following codes are determined directly, they are not from the criteria table.

FNOD No data was received. The time-stamp is correct, but no other data is usable.

FTIM Instrument time is wrong. The time stamp has been corrected to a reasonable value only so the user can determine what the time should have been. All data is considered invalid.

FSPG Average wind speed is greater than the wind gust

FCSW Wind data has been disabled by CORMS.

FCSA Air temperature has been disabled by CORMS.

FCSB Barometric pressure has been disabled by CORMS.

These codes are taken from the criteria tables.

Warning	Failure	Change	Description
WWSP	FWSP	DWSP	wind speed meters/second
WWSG	FWSG	DWSG	wind gust meters/second
WWDI	FWDI	DWDI	wind direction degrees True
WATM	FATM	DATM	air temperature degrees C
WAPR	FAPR	DAPR	air pressure millibars

APPENDIX V — CORMS and Sensor Control Status

The Continuous Operational Real-Time Monitoring System (CORMS) has the ability to remotely disable any PORTS sensor. This does not stop data collection or the generation of PUFFF files. The CORMS control fields show the present operational status of any sensor. If the sensor is flagged as disabled, the data is considered to be unreliable, **regardless** of any DQA or DQAC flags. The CORMS status line is in all PUFFF files. If a sensor is disabled, a DQAC failure code will also be generated, indicating that CORMS has disabled a particular sensor data type. In addition, following the CORMS control string is a Sensors Installed flag string.

NOTE: The CORMS control flags override ALL DQA and DQAC flags or indicators.

The CORMS status line consists of the word 'CORMS' in columns 1 through 5, a space, and then 32 consecutive one character fields of '0' or '1'.
A one in a field means the sensor is considered disabled. This overrides all DQA codes. A zero means the sensor is enabled.

Below are the currently defined fields. All other fields are considered to be undefined for users:

Field	Sensor
1	Water Level
2	Currents
3	Air Temperature
4	Water Temperature
5	Barometric Pressure
6	Water Pressure
7	Wind Speed, Wind Direction, Wind Gust
8	Salinity
9	Waves
10	Visibility

Therefore, a CORMS status line with the currents disabled would look like:
`CORMS 01000000000000000000000000000000`

APPENDIX VI — Revision History

6/23/99
Added water level rising/falling indicator on line 6 (the time line).
12/29/99
Changed anonymous FTP references from ceob-g30 to tidepool.
Changed references from opsd to co-ops.
Changed Jim Dixon's phone number.
1/16/01
Revised DQA bit masks and DQA codes to indicate that CORMS has disabled sensors. This basically replicates information from the CORMS control word to the station control word and DQA codes. Changed location of web page. Removed Jim Dixon as contact.

PUFFF Units File

Water Level Data

Water level data files contain the following measurements.

time-stamp	GMT
water elevation	millimeters
standard deviation	millimeters
outliers	counts

Salinity Data

Salinity data files contain the following measurements.

time-stamp	GMT
salinity	PSU*1000 (Practical Salinity Units)
temperature	degrees C*100

Current Data

RDI NarrowBand current meter data files contain the following measurements.

time-stamp	GMT
#bins	integer
B1 to Bn	bin number
U velocity (magnetic east)	millimeters/second
V velocity (magnetic north)	millimeters/second
W velocity (vertical)	millimeters/second
error velocity	millimeters/second
vector direction	degrees true
vector speed	millimeters/second
echo amplitude beam #1	relative dB
echo amplitude beam #2	relative dB
echo amplitude beam #3	relative dB
echo amplitude beam #4	relative dB
% good pings beam #1	percentage
% good pings beam #2	percentage
% good pings beam #3	percentage
% good pings beam #4	percentage
water temperature	degrees C*100
bindqa	DQA bin specific bit mask (each digit 0 or 1)
spectral	spectral width (0 to 255)

bstat	bin status (0 to 255)
rveloc	raw beam counts used for current speed (0 to 4095)

RDI BroadBand current meter data files contain the following measurements.

time-stamp	GMT
#bins	integer
B1 to Bn	bin number
U velocity (magnetic east)	millimeters/second
V velocity (magnetic north)	millimeters/second
W velocity (vertical)	millimeters/second
error velocity	millimeters/second
velocity direction	degrees true
velocity speed	millimeters /second
echo amplitude beam #1	relative dB
echo amplitude beam #2	relative dB
echo amplitude beam #3	relative dB
echo amplitude beam #4	relative dB
% good three beam solutions	percentage
% of transforms rejected	percentage
% of more than one bin bad in beam	percentage
% of good 4 beam solutions	percentage
water temperature	degrees C*100
bindqa	DQA bin specific bit mask (each digit 0 or 1)
corr%	correlation coefficient (percent, 0 to 100)
bstat	bin status (0 or 1)

SonTek current meter data files contain the following measurements.

time-stamp	GMT
#bins	integer
B1 to Bn	bin number
U velocity (magnetic east)	millimeters/second
V velocity (magnetic north)	millimeters/second
W velocity (vertical)	millimeters/second
error velocity	millimeters/second
velocity direction	degrees true
velocity speed	millimeters/second
echo amplitude beam #1	relative dB
echo amplitude beam #2	relative dB

echo amplitude beam #3	relative dB
standard deviation for beam #1	millimeters/second
standard deviation for beam #2	millimeters/second
standard deviation for beam #3	millimeters/second
water temperature	degrees C*100
bindqa	bin related DQA bit mask

METEOROLOGICAL DATA

Meteorological data files contain the following measurements.

time-stamp	GMT
wind speed	meters/second *10
wind direction	degrees true
wind gusts	meters/second *10
barometric pressure	millibars*10
air temperature	degrees C*100